

Formal Matters

Claim 1 has been amended to remove subject matter already incorporated in dependent claim 2.

Election/Restriction Requirement

In a telephone conversation on January 7, 1999 with William Shaffer restriction was required under 35 U.S.C. 121 to one of the following inventions:

Claims 1-6 drawn to a method.

Claims 7-10 drawn to an apparatus.

During the above telephone conversation, election was made, with traverse, to prosecute claims 1-6.

Applicants hereby confirm election with traverse to prosecute claims 1-6. The Summary Sheet to the Office Action dated March 29, 1999 indicates restriction of claims 7-10. The Office Action, however did not formally incorporate the above restriction requirement or a record of the above telephone conversation as set forth in MPEP 812.01. No reason was stated in the Office Action for the restriction requirement. In the absence of a written restriction requirement and statement of reasons for restriction, Applicant submits that the above restriction requirement is traversed.

The Rejection Under 35 U.S.C. 103(a)

Claims 1-4 and 6

Applicants respectfully traverse the rejection of claims 1-4 and 6. In rejecting these claims, the Examiner states that the Robertson reference teaches a plasma assisted CVD apparatus as set forth in claim 1. However, the Examiner states, Robertson fails to explicitly teach a RF powered lower electrode or a gas inlet manifold for supplying one or more process gases. The Examiner states that E. van de Ven teaches a dual frequency PECVD electrode design and Provence teaches an etch chamber that embodies a majority of the features of claim

1. According to the Examiner, Provence, however, does not describe a deposition chamber or an impedance monitor as recited in claim 1. The Examiner further states that Patrick teaches dynamic control and delivery of RF power in plasma process systems including measurement of chamber impedance. According to the Examiner, Patrick does not explicitly describe all the claim 1 limitations. However, the Examiner argues that Patrick explicitly meets the claim 1 limitation of an impedance monitor electrically coupled to the deposition chamber to measure an impedance level of the process plasma. The Examiner concludes that it would be obvious to enhance the Robertson apparatus with the plasma control of van de Ven and impedance control as taught by Patrick.

Applicants submit that the Examiner has not established a prima facie case of obviousness since obviousness cannot be established absent some teaching, suggestion or incentive supporting the combination (ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F. 2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)). Specifically, neither Robertson nor van de Ven, nor Provence teaches or suggests that it is advantageous to use an impedance monitor in a substrate processing system as set forth in claim 1. Absent such a showing in the prior art, the Examiner has impermissibly used Applicants teaching to hunt through the prior art for the claimed elements and combine them as claimed (see *In re Vaeck*, 947 F. 2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991); *In re Bond*, 910 F. 2d 831, 15 USPQ 2d 1566 (Fed. Cir. 1990); *In re Laskowski*, 871 F. 2d 115, 117, 10 USPQ 2d 1397, 1398 (Fed. Cir. 1989)). The use of hindsight is never permissible to establish obviousness.

Therefore, Applicants submit that independent claim 1 is not obvious over Robertson, van de Ven, and Provence in view of Patrick and is patentable under 35 U.S.C. § 103. Furthermore, dependent claims 2-4 and 6 depend, either directly or indirectly from claim 1 and recite additional features therefor. As such, and for the exact same reasons recited hereinabove, Applicants submit that these dependent claims fully satisfy the requirements of 35 U.S.C. § 103 and are patentable thereunder.

Claim 5

Applicants respectfully traverse the rejection of claim 5. In rejecting claim 5, the Examiner cited the reasons stated hereinabove with respect to Robertson as applied to

claims 1-4 and 6. In addition the Examiner states that Boys discloses a magnetron sputter coating apparatus having a pressure control system. The Examiner argues that it would be obvious to modify the apparatus of Robertson to include the impedance monitor of Patrick and the pressure control system of Boys.

As stated hereinabove with respect to claims 1-4 and 6, Applicants submit that the Examiner has not established a prima facie case of obviousness since obviousness cannot be established absent some teaching, suggestion or incentive supporting the combination.

Furthermore, no combination of the references cited in the rejection teaches or suggests all the limitations of claim 1. Specifically, claim 1 teaches a substrate processing system having a pressure control system configured to "vary the pressure within the chamber in response to the measured impedance level of the plasma." Boys instead teaches that "The control output signals increase or decrease the output of controlled devices to cause plasma pressure, plasma voltage, and plasma current to conform to the operator selected or programmed values for them" (see col. 9, lines 42-45). Furthermore, Boys teaches that the desired operating pressure (as well as voltage and current) are either operator selected or preprogrammed. The desired value is chosen in accordance with desirable operation of the sputtering process with respect to deposition rate, material distribution and target life (see col. 14, lines 25-29). Nowhere does Boys teach or suggest a pressure control system that changes pressure in a chamber in response to a measured level of plasma impedance. Instead Boys teaches that "The dependent controlled variable that can be changed to control the impedance of the plasma in volume 13 is the intensity of the magnetic field supplied by coil 21" (see col. 9, lines 23-24). The coil current, in turn, is controlled by changes in the plasma voltage (see col. 13, lines 25-27). As such the combination of Robertson with Boys (and presumably Patrick) teaches a substrate processing system in which impedance is controlled by changing magnetic field intensity in response to changes in plasma voltage.

Furthermore, Boys states that control of only the working gas pressure provides a narrow range of plasma impedance control (see col. 11, lines 62-64). Thus the Boys reference teaches away from the invention as recited in claim 5.

Therefore, Applicants submit that claim 5 is not obvious over the prior art of record and is patentable under 35 U.S.C. § 103.

Additional Comments on Selected Claims

With respect to claim 4, Applicants submit that, upon closer examination, Patrick teaches measuring RF parameters at the electrode and the use of these measurements to control the amount of RF power output by the RF generator to get a desired RF output at the electrode. Thus variance in power loss due to matching network 120 is eliminated (see col. 7 lines 4-20). Patrick does not teach or suggest changing capacitance in response to a measured impedance value as recited in claim 4. Furthermore, the variable capacitors 106 and 108 of Patrick are part of the matching network 120.

Therefore, Applicants submit that claim 4 is nonobvious over Robertson, van de Ven, and Provence in view of Patrick for at least this additional reason.

New Claims 11-18

New claims 11-18 have been added to cover specific aspects of the impedance monitor. Claim 11 recites a substrate processing system in which an HF electrode and a LF electrode are coupled to an impedance monitor. An impedance monitor connected to the HF and LF electrodes can independently measure voltage, current, and phase angle for LF power and HF power. HF power generally controls the plasma density while LF power generally controls the energy with which ions from the plasma bombard the substrate. Thus it is primarily the LF power that controls film properties in deposition. Applicant submits that no new matter has been added by this amendment. Support for claim 11 can be found in the specification at page 13, lines 18-23. Support for claims 12 and 13 can be found in the specification at least at page 28 lines 16-22 and FIGs. 1 and 5. Support for claims 13-16 can be found in the specification in FIG. 11 and original claim 8.

Claim 17 is a linking claim linking apparatus claims 1-6 to method claims 7-10. Support for claim 18 can be found in FIG. 11 and original claim 8. Applicants submit that linking claim 16 is allowable for the reasons set forth with respect to claim 1. Furthermore

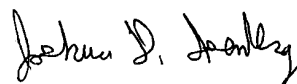
Applicants submit that claims 17 and 18 are not subject to restriction for the reasons set forth hereinabove with respect to the Election/Restriction Requirement.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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